Dynamic Data Icons: Graphical Display of Uterine Cervical Cytologic Exams, Diagnostic Studies, and Treatments

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The Papanicolaou smear (PAP) is one of the most common cancer screening exams done in the U.S with millions performed annually. An abnormal PAP usually leads to a colposcopy, multiple biopsies, therapy, and further PAPs. Even women who have normal PAPs will still generate a lifetime of data to be reviewed at each visit.

When a clinician reviews a patient's PAP history it is important that not only the PAP data be complete and organized chronologically, but that the actual data is presented in such a way that it is easily transformed into *information*. A clinician needs answers to questions like, "Has this patient had abnormal PAPs in the past?", "Since the last cryotherapy has there been an improvement in the cytologic findings?" This information, or clinical *picture*, should ideally be apparent at a glance, rather than by study.

It does not take an expert in human cognition to recognize that the human machine is capable of processing large amounts of visual data faster than any computer. One has to only consider the "simple" act of recognizing a familiar face and the colossal processing task it actually represents. Human cognitive and pattern-recognition abilities have been immensely underutilized in data display because of limitations imposed by obsolete, inflexible technologies like typeset printing and text-only terminals. With the introduction of graphical interfaces many of these man-made constraints can be overcome.

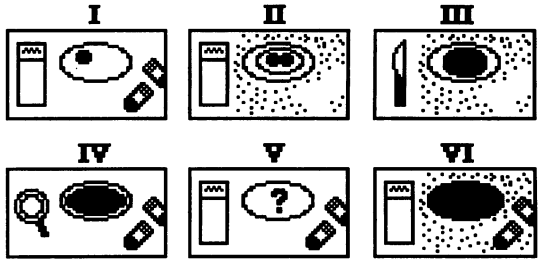
Graphic elements often function best when they are metaphorically or symbolically meaningful, based either on common human experience or the user's specific knowledge regarding the subject. However, abstract icons, with no apparent link to the data they represent, may also accelerate data interpretation.

A Dynamic Data Icon (DDI) is an icon which is programmatically assembled in layers from a small collection of graphical templates. The resulting icon will then symbolize the most significant data contained in the report. DDIs are not meant to replace a more detailed view of the data but rather to convey answers to common clinical questions in an overview format. Future work is planned to test the clinical utility of this concept. For this cervical pathology demonstration, 14 distinct graphical components were developed which can characterize over 670 distinct reports.

The primary graphic elements of these DDIs were designed to recreate, in a visually simple manner, actual cervical pathology findings. For example, the more dysplastic the squamous cell, the larger the nuclear/cytoplasmic ratio becomes. DDI icons reflect increasing cervical dysplasia with larger "nuclei" which fortuitously make dysplastic findings even more obvious. This graphic metaphor also capitalizes on the familiarity any clinician performing a PAP should have with cervical cytology so that learning the "metaphor" can be measured in seconds rather than minutes or hours.

Modern computing devices already easily manage dynamic conversion of textual data into graphic text. It may be time to change the paradigm of data display to include not just pictures of text, but pictures of pictures whose symbolism may lead to faster interpretation of underlying data.

Examples



I. Normal PAP, endocervical cells present, II. PAP, koilocytosis with inflammation, endocervicals absent, III. Biopsy, moderate dysplasia, chronic cervicitis, no endocervical cells identified, IV. Colposcopic impression of severe dysplasia, squamocolumnar junction identified, V. PAP, atypical cells of undetermined significance, endocervicals present, VI. PAP, squamous cancer, inflammation, endocervicals present.

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